

DOCUMENT RESUME

ED 273 242

IR 012 236

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TITLE Managing Training of Military Units: Development of a Management Information System.
PUB DATE Apr 86
NOTE 8p.; Paper presented at the Annual Meeting of the American Educational Research Association (67th, San Francisco, CA, April 16-20, 1986).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Databases; Data Collection; Formative Evaluation; *Management Information Systems; *Military Training; *Program Development; *Program Effectiveness; Systems Analysis; *Systems Development; *Training Objectives
IDENTIFIERS Army

ABSTRACT

An automated management information system was developed for planning and scheduling unit training in a U.S. Army infantry division. The primary goal of the project was to test the feasibility of the concept for a computer-based management information system. Specific objectives were to integrate information on personnel, training, and logistics required for training management and to support targeting of training activities based on priorities, needs, and resources. The methods used for system design included a detailed requirements analysis, a prototype of a selected battalion, and formative evaluation by an independent agency to test the concept and identify strengths and weaknesses for project improvement. The system included a minicomputer, 13 terminals plus 3 portable microcomputers, 10 dot matrix printers, and a letter quality printer. Data were collected for evaluation via questionnaires administered before and after installation, observations, computer usage records, and user testing on system tasks. It was found that soldiers could learn to use the system, and that both management of training and communication within the battalion could be improved by using the system. This report concludes by discussing the importance of the effort and outlining future directions for research and development. (DJR)

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ED273242

Managing Training of Military Units: 1,2
Development of a Management Information System

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Managing training of military units is a complex and difficult activity. A typical Army battalion has hundreds of collective tasks on which subordinate companies/batteries, platoons/sections, squads, crews and teams must be trained. Within a battalion, there are hundreds of soldiers with numerous job specialties (military occupational specialties or MOS's). Each MOS has hundreds of individual job tasks on which soldiers must be trained. Furthermore, units are continually undergoing changes in personnel so that the training needs of units and their soldiers do not remain stable. And, with the ongoing force modernization program, units are acquiring sophisticated high technology equipment which dictates new training requirements calling for higher degrees of soldier skill than ever before.

Planning and scheduling an effective and efficient training program requires intricate coordination of leaders (trainers and evaluators), soldiers, and resources (such as ranges, equipment, fuel, and ammunition) to ensure that the right people are brought together at the right time with the right equipment. In addition, flexibility must be built into the planning process so that training schedules can be changed to accommodate shifting command priorities and operational taskings.

Training management has traditionally been accomplished using a manual, paper-based system that is often incomplete and sometimes unreliable, thus forcing planners to rely on memory and opinions. While data on personnel and logistics useful for identifying training needs and allocating resources to training activities are held in large-scale automated data bases, no mechanism has been available for training managers to readily access this information. Thus, in order for battalion and company staff to use the limited available information systematically in planning and managing training, they have to sort records by hand, abstract out relevant information, and prepare summaries manually--an inefficient, error prone and time-consuming process that ordinarily cannot, as a practical matter be accomplished.

The purpose of this paper is to describe the development of an automated management information system for unit training designed for a U.S. Army infantry division. First, a brief overview of the project and the methods used in developing the system are provided. Then the system is described and the

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results of a formative evaluation are presented. The paper concludes with a consideration of the importance of the effort and outlines future directions for research and development.

Project Overview

The primary goal of the project was to test the feasibility of the concept for a computer-based management information system for unit training. Specific objectives for the computerized system were: 1) to facilitate access to information on training, personnel, and logistics required for training management by designated decision-makers; and 2) to support appropriate targeting of training activities based on command priorities and analyses of training needs as well as efficient allocation of scarce training resources.

The perspective adopted for the project balanced technological and human considerations. Emerging microcomputer and other electronic technologies were capitalized on to build a powerful and highly capable system. However, all design and development work was accomplished with careful attention to user needs, human factors considerations, and the underlying climate required to foster the credibility and acceptance of such innovations.

The methods used for system design and development included a detailed requirements analysis, prototype development in a selected battalion, and formative evaluation by an independent agency. The requirements analysis was based on interviews with division level managers in personnel, logistics, and automated data processing and with members of the host battalion as well as several other battalions, review of Army manuals and job aids, abstraction and synthesis of data definitions from existing division-level data processing systems and local battalion-level reports, and the development of new reports and procedures where appropriate (Lavin, Rosenberg, and Gray, 1985). The prototype was developed and implemented in one artillery battalion with all its subordinate units as a test bed (1/11, 9 Infantry Division, Ft. Lewis, WA). Such prototype development is a useful system design technique, since it allows for rapid application development and user testing in a real-world situation (Benson, 1984). Finally, a formative evaluation of the system was conducted by an external test agency, the Combat Developments Experimentation Center (CDEC), to test the feasibility of the concept and to identify strengths and weaknesses of the system.

System Description

The main computer was a VAX 11/750 mini-computer located in the battalion headquarters building. Thirteen terminals, plus three portable micro-computers (Grid Compass), were hard-wired to key offices and the battery headquarters to make them easily available to users. Ten dot matrix printers were connected to

selected terminals and a letter quality printer was located in the Battalion headquarters. The system had a hard disk mass storage capability of 485 mega-bytes with tape back-up.

System software included the VAX/VMS operating system and a relational data base management system (INGRES). The operating system provided system services which schedule and allocate resources, such as memory and processing time, drive the hardware devices, such as terminals, disks, and printers, and allow users to send mail electronically. INGRES can be used directly to create databases, update and retrieve data, and write reports. Menus were written using INGRES for personnel, training, and logistics to provide specific applications for each of the three functional areas, as outlined below. (See Antczak, Benson, and Ibbott, 1985a for a complete description.) In addition, word processing software (MUSE) allowed users to prepare text on-line.

The personnel portion of the database stored all the data about an individual soldier (except unit-based training scores) including education and school training and special qualifications. The user was able to add soldiers to the data base, update or retrieve any data about a soldier, enter status for soldiers who were absent for duty or from training, enter a soldier into a special purpose roster (e.g., drivers, special status) request specific personnel reports (e.g., skill inventory, unit manning), and make queries about supporting data (e.g., education).

The logistics portion of the database allowed users to keep track of the status of each piece of equipment maintained by the battalion (e.g., trucks, jeeps, howitzers, rifles, tents, and other equipment necessary to fight a war). The database included static information such as the description, model number, and serial number of each piece of equipment. In addition, it contained dynamic data such as the current operational status of the equipment, the soldier currently responsible for the equipment, service schedules and repair history. Also kept was data on the quantity and reorder status of spare parts.

The training portion of the database allowed the user to build training schedules, keep track of training scores, and create training reports. The system handled ARTEP (Army Training and Evaluation Program) tasks, MOS tasks, Common Skills, Physical Training (PT) Qualification, and Weapons Qualification.

System security was provided at the operating system level using the standard VMS password and User Identification Code (UIC) based protection system. Within the database, INGRES provided varying levels of protection via permit files. In general, a user was only allowed to view data pertaining to his own battery. Data access was also tailored to function so that, for example, a logistics clerk was not able to update personnel

data even for soldiers within his own battery. Exceptions were made for battalion staff officers and their representatives who had broader access.

Formative Evaluation

A formative evaluation was conducted by an independent agency, CDEC, to test the concept and to identify system strengths and weaknesses for project improvement. System users included 78 soldiers (enlisted men and officers) ranging in grade from E-2 to the Lieutenant Colonel in command. Training was conducted in the battalion over a six-month period. While there was considerable variation in the amount of training received by users, the median time for formal training was 3 hours and the median time for supervised on-the-job training was 5 hours.

Data collection included questionnaires for system users administered before system installation (N=55) and after system installation (N=34), observations made by 11 data collectors across a two week period, computer usage records, and user testing on specific system tasks.

Results of the study were organized around three major issues: 1) Can soldiers learn to use the system?; 2) Can training management be improved by the computer system?; and 3) Can communication within the battalion be improved using the computer? The findings for each issue are summarized briefly below. (See CDEC, 1984 for a fuller discussion.)

The ability of soldiers to use the system was examined using data from user testing sessions, computer usage records, and questionnaires. Of 52 designated users who were tested, 46 could send and receive electronic mail, 32 could retrieve data from the data base, and 22 could perform complex data base queries. In addition, 42 actually used the system for accomplishing their work duties during the two-week observation period. Finally, the perceptions of supervisors gathered from questionnaires were that computer operators required the same amount of supervision as clerks under the manual system (thus achieving higher productivity with the computer).

Information about the influence of the computer system on training management was gathered primarily through questionnaires. Questionnaire responses indicated that three of the four full-time training non-commissioned officers (NCO's) preferred the computer to the manual system. In addition, all officers who had received training on the automated system preferred the computer system for managing training activities, as well as for personnel and logistics functions. Furthermore, there was general agreement among all users that useful information, not otherwise practically available, was obtained with the computer. Once a query was written, information was

acquired within seconds or minutes, as compared to hours with the manual system.

The effects of the automated system on communication within the battalion were examined using computer usage records and questionnaire responses. During the test period, 90% of the users used the E-mail capability of the system. Further, about two-thirds of the questionnaire respondents (69%) indicated that training schedules were easier to prepare and change. A similar proportion (65%) reported standardization of battalion operations as a potential benefit of the system.

Three suggestions for system improvement were made by the test agency based on the data collected. In view of positive relationships observed between amount of training and user ability to operate the system (as well as attitudes toward the automated system), CDEC recommended the development and implementation of a standard training program for users (a rapid implementation field-test schedule had precluded preparation of a formal training program). Similarly, CDEC noted the need for operator manuals and self-teaching training materials (again, time had not been available for their development). Both were subsequently developed (see Antczak et al, 1985a,b). In addition, the desirability for enhancements to the hardware or software to speed operations under high use conditions was also noted.

Importance of the Project

The research reported here constitutes the first implementation of a battalion- and company- level management information system for Army training. The system integrated information on personnel, training, and logistics that could be used for managing individual soldier and unit collective training.

The primary conclusion from this effort was that an integrated management information system was a powerful management tool for the battalion commander and his staff. Further, using a relational data base management system avoided the need to spend time and money to develop complex computer software and offered great flexibility in answering queries that could not be anticipated. In addition, the word processing and graphics capabilities of the system streamlined administrative operations and provided leaders with more time for addressing issues related to training. Finally, the electronic mail and computer-generated print-outs improved internal communications within the battalion.

Based on the results of this research, a decision was made by the Army's Director of Training and the 9th Infantry Division, in conjunction with the Training and Doctrine Command, to build a division-wide system as a prototype for all Army divisions. Currently, the front end analysis for this follow-on effort has

been completed and prototype design is underway by the Army Development and Employment Agency (ADEA) at the 9th Infantry Division, Fort Lewis, WA.

Future Research

Directions for future research include an "Electronic Clipboard" to aid in field data collection and subsequent data entry, and special purpose software to assist users in scheduling training. A prototype version of the "Electronic Clipboard" has been developed and successfully field-tested. This hand-held device shows great promise for downloading training and evaluation information from the larger information system for use in the field, for displaying, entering, and storing training and evaluation information collected in the field, and for uploading performance data into the unit training data base (Perceptronics, 1986).

A second line of inquiry emerging from this effort is centered around the development of decision support software to assist training managers in effectively using information in the database for identifying training needs of units and individual soldiers and for efficiently scheduling activities to ensure maximal use of training resources (see, for example, Hart and Goehring, in press).

It is expected that such technological refinements to an automated training management system coupled with attention to the communication process between system designers and users and the creation of a receptive psychological climate will bring marked improvements in training efficiency and effectiveness. These improvements will result from a systematization of relevant information, reduction of cognitive load on decision-makers, ready availability of evaluative information for use in determining training needs, and the capability to explore multiple "what if" scenarios for alternative utilizations of training time and resources.

Footnotes

1. This paper was presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, 1986.

2. The opinions expressed in this paper are the views of the authors and do not represent an official U.S. Department of the Army position.

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